Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

aHn52Ah

A.H.D.No. 50 January 1942

FEB 1 1942
U.S. Department of Agriculture

United States Department of Agriculture
Bureau of Animal Industry
Animal Husbandry Division

Wool Yield Determination in which Small Samples are Compared with Whole Fleeces

by

Ralph G. Schott, Elroy M. Pohle, Damon A. Spencer, and Glenn W. Brier * #

The improvement of sheep for the production of maximum quantities of clean wool is a problem of vital importance to sheep breeders and investigators who are working in the field of sheep and wool improvement by the application of breeding methods. Variations of fleeces in their content of clean wool make it necessary to determine the percentage of actual wool for individual fleeces of sheep that are used in any breeding program involving such wool improvement. The need for economy in the process of determining the clean wool content of fleeces has stimulated investigators to test the possibility of making such determinations with representative samples of wool instead of the expensive and time-consuming method of scouring entire fleeces. For the purpose of investigating this possibility of using samples of wool for proving their wool content, the undertaking herein reported was conducted by the use of 174 fleeces from yearling Rambouillet, Targhee, Corriedale, and Columbia sheep maintained under range conditions at the Western Sheep Breeding Laboratory and United States Sheep Experiment Station, Dubois, Idaho. These fleeces were sampled and sheared in 1938 and 1939.

The sheep used in this undertaking were operated under intermountain range conditions at an altitude of 5,000 to 8,500 feet above sea level. The grazing periods were rotated to conform with good grazing practices during various seasons of the year, on spring-fall, summer, and winter range, and the sheep were maintained in the feed lot during the extreme dead of winter. The fleeces were from 45 Rambouillet, 40 Targhee, 44 Corriedale, and 45 Columbia ewes, as shown in table 1.

---

*Ralph G. Schott, animal husbandman in sheep breeding, Beltsville Research Center, Beltsville, Md.; Elroy M. Pohle, associate animal fiber technologist, U. S. Sheep Experiment Station and Western Sheep Breeding Laboratory, Dubois, Idaho; Damon A. Spencer, senior animal husbandman, Washington, D. C.; Glenn W. Brier, formerly junior statistician, Beltsville Research Center, Beltsville, Md.

#The authors express appreciation, for helpful assistance, to Julius E. Nordby and John I. Hardy of the Bureau of Animal Industry, and to Robert H. Burns of the Wyoming Agricultural Experiment Station and formerly of the Agricultural Marketing Service, Warner M. Buck and George C. LeCompte of the Agricultural Marketing Service, U. S. Department of Agriculture.

Table 1

AVERAGE CLEAN WOOL YIELDS OF WHOLE FLEECES AND SAMPLES AND THEIR RESPECTIVE CORRELATION COEFFICIENTS

Breed	No. of samples and fleeces	Average percent yield: Small sample	Average percent yield: Bone-dry whole fleece*	Average percent yield: Deviation of small sample means from whole fleece means	Correlation coefficient
Rambouillet	45	35.6	35.6	0	0.76
Targhee	40	38.3	37.0	1.3	0.71
Corriedale	44	42.0	39.6	2.4	0.84
Columbia	45	44.2	40.3	3.9	0.88
Total or average	174	40.052	38.149	1.903	0.80

The samples of the fleeces were taken at the middle of the right side of the sheep midway between the scapula and hip joint and midway between the backbone and belly. The sample areas were sheared with an electric clipper (Shearmaster) and averaged approximately 5.2 centimeters (2 inches) wide and 11.0 centimeters (4-1/3 inches) long. This area yielded from 25 to 35 grams of wool that was immediately placed in a moisture-proof container until it was scoured. The procedure was similar to that described and illustrated by Hardy (3) as routine for taking yield and density samples. After being weighed, the wool in the small samples was opened by hand, and the whole fleeces were passed through a mechanical fleece opener which removed loose dirt and vegetable matter. The scouring was done by the emulsion process described by Buck (1), Burns (2), Hardy (3), Spencer et al (4), and Wilson (5). The percentages are based on bone-dry determinations of clean wool for both the small samples and whole fleeces. The percent yields of the small samples were determined by the Bureau of Animal Industry at the Western Sheep Breeding Laboratory, Dubois, Idaho, and the whole-fleece yields by the Agricultural Marketing service at Washington, D. C., in conjunction with studies on commercial yields of wool. The clean yields of the small samples were compared with the yields of the respective whole fleeces, the averages of which are shown in table 1.

---

*Bone-dry, clean wool yields may be converted to commercial yields by dividing the bone-dry percentage by 0.88, the result of which gives the percentage of clean wool containing 12 percent moisture. Thus the percentages of clean wool shown for whole fleeces in this table on the bone-dry basis, would on the commercial basis change to 40.5 percent for Rambouillet; 42.0 for Targhee; 45.0 for Corriedale; 45.8 for Columbia; and 43.4 for the average.

Discussion of Results

A review of table 1 shows that the 45 samples from the Rambouillet fleeces averaged a clean-wool yield of 35.6 percent, the same average of clean wool as was obtained from the 45 whole fleeces of this breed. However, the correlation of 0.76 for the Rambouillet wool samples and fleeces was not so great as the correlation for the samples and fleeces of the Columbias, even though the differences between the averages of the yields of the small samples and respective whole fleeces of the Columbias differed as much as 3.9 percent.

An analysis of the details of this study shows that of the 45 Rambouillet samples 6 yielded exactly the same percentages of clean wool as the fleeces from which they were obtained, while 19 of the samples yielded less, and 20 of them yielded more clean wool than their respective whole fleeces. This fluctuation of the yields of the samples from the yields of the whole fleeces, being approximately the same in the number that was less as the number that was greater than the means for Rambouillets, furnishes a logical basis for the identical averages observed for the small samples and whole fleeces for this breed.

In comparing the 45 samples from the Columbias with their respective 45 fleeces we found that 43 of the samples yielded more, 1 yielded less, and 1 was exactly the same in clean wool content as their respective whole fleeces. The correlation coefficient for these Columbia samples and fleeces was 0.88, the highest for any breed group in this study, even though the average percentage of clean wool contained in the Columbia samples was 3.9 greater than the clean wool content of their whole fleeces. The samples from the Columbias being so consistently cleaner than their whole fleeces leads to a logical acceptance of the relatively high correlation coefficient.

Inspection of the column of deviations of small samples from whole fleeces for the four breeds shows that the deviations increase from 0 for the Rambouillets, to 1.3 for Targhees, 2.4 for Corriedales, and to 3.9 for the Columbias. It is, therefore, highly desirable to develop a method of evaluating the clean wool yields of fleeces in terms of the yields found in the small samples by allowing for the differences that exist between samples and whole fleeces. A study of the regression for each of the 4 groups of fleeces has provided a method which is shown graphically in figure 1.

It will be observed in figure 1 that the expression $b = 1.00$ signifies that the dotted line illustrates a perfect regression in which y, the small sample yield in percent, is identical with x, the whole fleece yield in percent. Close inspection shows that there is a deviation from the perfect 45 degree angle of the dotted line in every case where the solid lines represent fleeces of the different breeds of sheep.

The slopes of the regression lines are practically identical for the four breeds, and the regression factor, or constant for slope, $b = 1.08$, applies to any of the breed groups. Since the groups differ in levels the part of the regression

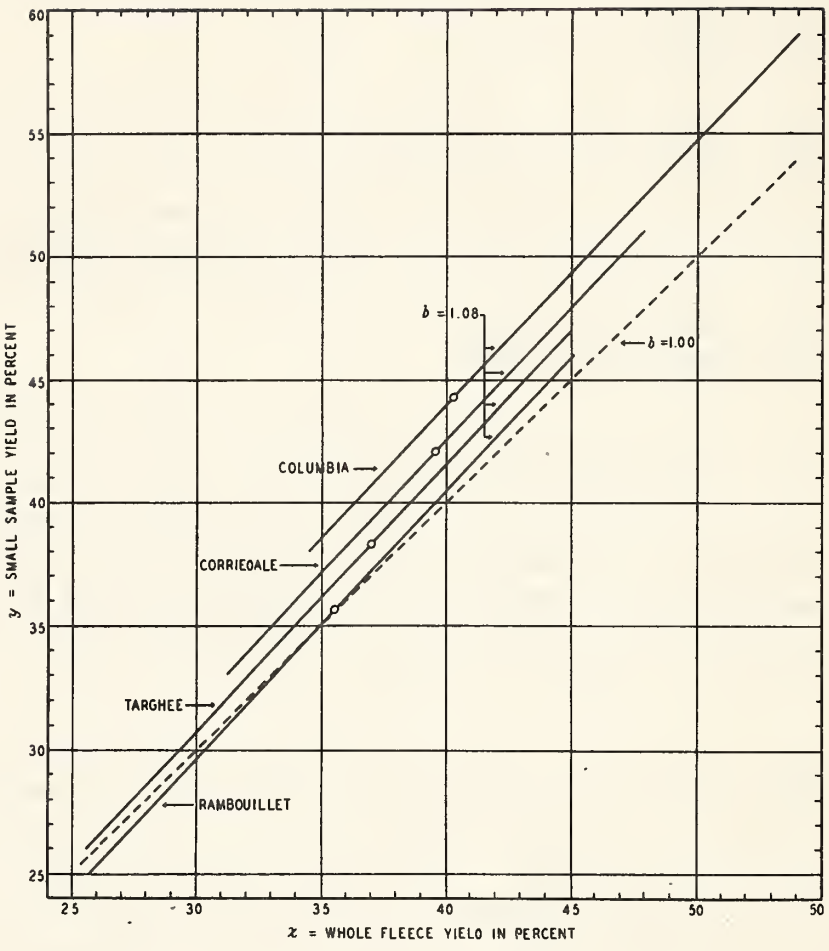

Figure 1. Regression relationship of yields of small samples on whole fleece yields of Rambouillet, Targhee, Corriedale, and Columbia sheep.

that represents this is given by the factor, or constant for regression level, a, and for each group these values are: Rambouillet, -2.86; Targhee, -1.62; Corriedale, -0.84; Columbia, +0.73. The placements of the regression lines in figure 1 are based on these values of b and a, and the reading of a whole fleece value from any observed sample can be made directly on this graph.

When using the lines in figure 1 to estimate the yields of the whole fleeces from the determined yields of the small samples it will be observed that when the Rambouillet regression line reaches the horizontal line marked 30 for the y phase, small sample yield in percent, the perpendicular line that would intersect at that point indicates that the x phase, whole fleece yield in percent, would be 30.5. Following up on the Rambouillet regression line to the o which indicates the mean at 35.6, the y and x phases are identical because, as was shown previously, the means of the samples and whole fleeces were identical.

Proceeding further up the Rambouillet regression line to its intersection with the horizontal line 40 of the y phase, we find that it also intersects with the perpendicular line 39.7, which means that if the Rambouillet sample shows a clean yield of 40 percent the fleece can safely be estimated to represent 39.7 percent. Using this same method of estimating clean yield in whole fleeces on the basis of yields of fleece determinations in the small sample, a Targhee sample yielding 40 percent clean wool would represent a fleece yielding 38.5 percent. A Corriedale sample yielding 40 percent would represent a fleece yielding 37.8 percent. A Columbia sample yielding 40 percent would represent a fleece yielding 36.4 percent.

If a fleece value is to be calculated rather than read from figure 1, or calculations are to be made to check the readings, the observed sample minus factor a of the particular breed group divided by b will give the estimated fleece value, that is, $\frac{\text{observed value of sample } y - a}{b} =$ estimated fleece value. Thus, using a small-sample clean-wool yield of 40 percent for Columbias, we have $\frac{40-(0.73)}{1.08} = 36.36$ for the calculated value, and a sample yield of 40 percent for Rambouillets gives $\frac{40-(-2.86)}{1.08} = 39.68$ as a calculated check on the readings given in the previous paragraph.

It should be remembered that this paper is based on yearling sheep maintained under intermountain range conditions near Dubois, Idaho, and the facts set forth herein are for the purpose of illustrating a method of estimating clean yields of fleeces with small samples obtained from experimental sheep. The use of a regression chart such as is illustrated is regarded as useful when it appears that the need for accuracy is great enough to justify its development. It would be desirable to use this regression chart with caution and to watch for opportunity to conduct similar investigations with sheep of other breeds, ages, and environments.

Literature Cited

1. Buck, W.M.,
1940. Progress in wool shrinkage research during the year 1939. U.S.D.A. mimeograph report, 32 pp.

2. Burns, R.H.,
1940. Sampling clips of wool for shrinkage determination. U.S.D.A. mimeograph report, 34 pp.

3. Hardy, J.I.
1934. Wool Yield and Fleece Density can be measured by a simplified method. USDA Yearbook of Agriculture, 1934, illus., Pp 378-380.

4. Spencer, D.A., J.I.Hardy, and Mary J.Brandon.
1928. Factors that influence wool production with range Rambouillet sheep. USDA Tech. Bul. No.85, Illus., 48 pp.

5. Wilson, J.F.
1938. The determination of yield and shrinkage of wool by scouring small samples. Hilgardia, vol.11 (4), illus., pp 149-172, a publication of the University of California, Berkeley, Calif.